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STUDY REPORT

An assessment of Health Facilities Laboratory Performance in diagnosing febrile illnesses in the Lake Zone, Tanzania



APRIL 2015

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DISCLAIMER

The contents of this report are the sole responsibility of University Research Co., LLC (URC) and do not necessarily reflect the views of the United States Agency for International Development (USAID) or the United States Government.

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EXECUTIVE SUMMARY

Background

The Government of Tanzania through the Ministry of Health and Social Welfare in collaboration with various stakeholders continues to work against childhood morbidity and mortality. Tibu Homa Program (THP) is implementing a comprehensive program to manage common causes of morbidity and mortality among under-fives in regions of the Lake Zone. In order to realize its goals, THP launched the study to assess the performance of facilities laboratories in diagnosing febrile illness among children under-five in the Lake Zone. The assessment looked at availability of laboratory personnel, laboratory investigations and possible limitations in diagnosis of under-five morbidities. These factors may mask the quality and output of health care training that is provided by THP.

Objectives

To assess health facilities laboratory performance and associated limitations in the diagnosis of febrile illness in the Lake Zone of Tanzania.

Methodology

This was a comparative cross-sectional study conducted in three Lake Zone Regions (Mwanza, Kagera and Shinyanga). Two hospitals (one public and the other private) among the THP supported hospitals and two hospitals (one public and the other private) among non-THP supported hospitals were selected for the study. (See sections on study design and target area below) A similar number of health centers was included. The number of dispensaries selected was twice that of hospitals or health centers. The analyses involved descriptive statistics and comparison of means using the t-test with a p-value of less than 0.05 indicating availability of significant differences.

Results

Health facilities in the Lake Zone are experiencing a shortage of laboratory health care personnel. Health centers and dispensaries experience the shortage more than the higher level health facilities. The team found high shortfalls in laboratory investigation and performances at both the health centres and dispensaries relative to the expected number of such performance. The average number of types of laboratory investigations in health centres did not differ statistically by study arms. The team found a significantly increased average number of types of laboratory investigations performed in dispensaries in the intervention arm as compared to those in control arm.

Conclusion

Health laboratories in the Lake Zone of Tanzania face a serious shortage of staff, equipment and supplies. In addition to other possible reasons, unavailability and insufficient laboratory personnel, equipment and supplies are among the causes of poor laboratory investigations. Although THP is not currently focusing on placement of laboratory personnel and provision of equipment and essential supplies, results from this study suggest the need to address these two types of shortages in order to realize the effect of trained health care workers with improved skills in improving case management. Without this component, the study believes the quality of diagnoses and treatment of under- fives with fever in the Lake Region will remain a problem.

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ACRONYMS

BS	Blood Smear
CI	Confidence Interval
CSF	Cerebrospinal Fluid
DMO	District Medical Officer
FBP	Full Blood Picture
HB	Haemoglobin
HW	Health Worker
IMCI	Integrated Management of Childhood Illness
IRB	Institutional Review Board
MDG	Millennium Development Goal
mRDT	Malaria Rapid Diagnostic Test
PI	Principle Investigator
RA	Research Assistant
RBG	Random Blood Glucose
RMO	Regional Medical Officer
THP	Tibu Homa Program
URC	University Research Co., LLC
USAID	United States Agency for International Development
WHO	World Health Organization

1. BACKGROUND

The Ministry of Health and Social Welfare in Tanzania and their stakeholders are progressively working against childhood morbidity and mortality. Among these stakeholders, Tibu Homa Program (THP) is implementing a comprehensive program to manage common causes of morbidity and mortality among under-fives in the Lake Zone (Geita, Kagera, Mara, Mwanza, Simiyu and Shinyanga regions). In order to achieve this objective, THP's main strategy is through training of health care workers to improve their skills in case management as part of the components of Integrated Management of Childhood Illness (IMCI)¹.

In poor-resource countries, management of morbidities is always hampered by several limitations^{2, 3}. However, the need of other essential diagnostic supplies and equipment has been highlighted in these countries and beyond⁴⁻⁶. In Tanzania, quality laboratory services are greatly compromised by lack of trained personnel, reagents and other related supplies^{7, 8}. Therefore, there is need to balance between human resources (availability and quality) and infrastructure (equipment and drugs). This study aims to assess performance of health laboratories and possible limitations of diagnosing under-fives morbidities.

2. OBJECTIVES

The main objective of this study was to assess the health facility laboratory performance and associated limitation in the diagnosis of causes of fever in the Lake Zone of Tanzania.

2.1 Specific Objectives

1. To determine the number of lab personnel and their cadres at health facility level
2. To determine proportion of health facilities performing basic investigations
3. To assess the limitations to perform various investigations at the health facility

3. METHODOLOGY

3.1 Study Design

The assessment was a quasi-experimental facility-based design (QED). The intervention arm constituted a sample of health facilities that are supported by THP and the control arm containing a sample of health facilities not supported by THP. Although no exact matching was applied, we considered type and ownership (public and private) of the health facility in both arms.

3.2 Target area

The aim was to include six (Mwanza, Geita, Mara, Kagera, Shinyanga and Simiyu) regions from which some health facilities are supported through THP. Nevertheless, a sample of two regions (Mwanza and Kagera) was selected to make up a study area (Table 1). From each of the selected region, one district hospital, two health centers and four dispensaries were included in the assessment as indicated in Table 1. In addition we selected two hospitals from Shinyanga region to compensate for public and private hospitals that we could not get as part of the control study arm.

3.3 Study population

The target sites were hospitals, health centres and dispensaries. Selection of these sites also considered ownership (public or private). Table 1 summarizes health facilities that were included in the study.

Table 1. Health facilities by level, ownership and study arm selected for the study

Facility Level	Intervention arm		Control arm	
Hospitals	Nyamagana – Mwanza (Public)	Rulenge – Kagera (Private)	Kahama – Shinyanga (Public)	Magai – Shinyanga (Private)
Health Centres	AICT Makongoro – Mwanza (Private)	Kaigara – Kagera (Public)	Kiloleli Juu – Mwanza (Private)	Izigo – Kagera (Public)
Dispensaries	Nyakahoja – Mwanza (Private)	Buhembe – Kagera (Public)	Kirumba – Mwanza (Public)	Katoke – Kagera (Public)
	Imani ELCT – Mwanza (Private)	Kagemu – Kagera (Public)	Nyasaka – Mwanza (Private)	Rwigembe – Kagera (Private)

There were four hospitals, four health centres and eight dispensaries. The number in each health facility level was split equally by the two study arms.

3.4 Data collection instruments and procedure

A face-to-face questionnaire was used to capture information on performing different investigations and associated challenges to perform these investigations. The survey instrument was divided into two main sections:

- (a) Background information of the health facility and of the respondent
- (b) Investigations performed and challenges.

All questions in this tool were structured and responses were pre-coded.

3.5 Selection and training of research staff

Study personnel included four (4) research assistants (RAs); each with a medical degree, two (2) supervisors from THP (a study coordinator and a paediatrics specialist) and a consultant (statistician). All RAs were introduced to the objectives of the study, components of the tool and all RAs went through each question for familiarization.

3.6 Data processing and analysis

Data were analyzed using Statistical Package for Social Science (SPSS; Version 19) software whereby the main procedure was descriptive.

In Table 2, we present eligibility of each health facility level in performing various laboratory investigations.

Table 2. Laboratory Tests requirements at health facility level

LEVEL	NAME/TYPE OF INVESTIGATION														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
H	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
HC	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	Y	Y
D	Y	Y	Y	Y	N	Y	Y	N	N	N	N	N	N	N	Y

KEY: 1=BS; 2=MRDT; 3=HB; 4=Stool analysis; 5=Chest X-ray; 6=RBG; 7= Urinalysis; 8=Widal test; 9=Lumbar puncture; 10=CSF; 11=Urine culture; 12=Blood culture; 13=FBP; 14=CD4 Test; 15=HIV test.

LEVEL: H=Hospital; HC=Health Centre; D=Dispensary. Y=Type of investigation is a requirement; N=Type of investigation not a requirement.

4. RESULTS

4.1 Description of study sites

Information was obtained from 16 health facilities, four hospitals, four health centres and eight were dispensaries.

Laboratory personnel

Table 3 presents the number of health laboratory personnel (by establishment and those available) and their positions by type of health facility. Though not a requirement, none of the hospitals had a principal laboratory technologist. Health centres reported more shortages of laboratory staff by 50%. On average, each health centre has 1 laboratory assistant against the required number of 2 and they have 1 laboratory technician against the required number of 2. Dispensaries had an average of 2 laboratory assistants which is the minimum requirement.

Table 3. Total # and positions of laboratory personnel by establishment level at facility

Position	Hospital (n=4)		HC (n=4)		Dispensaries (n=8)	
	Estab	Av	Estab	Av	Estab	Av
Lab Assistant	4	14	2	5	2	7
Lab Technician	3	5	2	2	0	4
Lab Technologist	3	8	0	2	0	0
Sen. Lab Technologist		2		0	0	0
Princ. Lab Technologist	NOT AVAILABLE AT ALL LEVELS					

Estab = Establishment Av = Available

4.2 Performance of laboratory investigations

The total number of equipment considered for assessment was 15. Defined by the Ministry of Health and Social Welfare, the average expected number of equipment at the hospital level was 15, at health centre 12 and at a dispensary level 7. The average number of investigations for diagnosing general illnesses per health facility level is presented in Table 4. Almost all of these investigations are also used to diagnose

febrile illness in children under-five years of age. This assessment did not investigate the quality of the tests.

Table 4. Average number for type of investigations per health facility level

Level	Expected	Available average	p-value [t-test]
Hospitals (n=4)	15	10	0.089
Health Centres (n=4)	12	7	0.009
Dispensaries (n=8)	7	4	0.006

Based on Table 4, there were on average 10 types of investigations at the hospital level making a shortfall of five (5) investigations. The shortfall was not significant ($p=0.089$). The shortfalls were significant at both the health centre and dispensary levels (available average from the expected number of investigations).

Table 5. Average number of types of investigations by facility level and study arm

Level	Study arm	Expected	Available	p-value [t-test]
Hospital (n=4)	Intervention (n=2)	15	8	$p > 0.5$
	Control (n=2)	15	11	
Health Centre (n=4)	Intervention (n=2)	12	8	$0.2 < p < 0.3$
	Control (n=2)	12	6	
Dispensary (n=8)	Intervention (n=4)	6	6	$p < 0.001$
	Control (4)	6	1	

Although the study found hospitals in the control study arm performing more types of investigations than those in the intervention arm (11 against 8), the difference was not statistically significant. Similarly the average number of types of laboratory investigations in health centres did not differ statistically by study arms (6 against 8). The study found a significantly increased average number of types of laboratory investigations performed in dispensaries in the intervention arm (6) as compared to those in control arm (1) ($p < 0.001$) (Table 5).

The number of laboratory performance for the 15 main investigations is summarized in Table 6.

1. Blood smear microscopy

All hospitals and all health centres were performing thick blood smear to detect the percentage of red blood cells which are infected i.e. parasite density. There were three (3) dispensaries that were NOT performing BS. The reasons given for not performing BS were lack of equipment, inadequate personnel and lack of space (Lab not available) for the investigations (one site was closed by the MoHSW).

2. Malaria Rapid Diagnostic Test (mRDT)

Of the 16 facilities involved in the study, almost half (7/16) were NOT performing mRDT (one hospital, two health centres and four dispensaries). Most (5/6) of those not performing mRDT mentioned that they do not have reagents and one health facility had neither equipment nor enough personnel (one health facility that did not have a laboratory did not have a laboratory personnel either).

3. Haemoglobin (HB) test

Half (8/16) of all facilities surveyed were not performing HB test. One health facility among hospitals and one among health centres were not performing HB test. One hospital and three dispensaries had not reagents, one hospital, one health centre and one dispensary had no equipment and another dispensary mentioned to have no laboratory personnel.

4. Stool analysis

Out of 16 health facilities included in our sample, 5 were not performing stool analysis i.e. one hospital and 4 dispensaries. None of the health centers was performing stool analysis. One hospital and two dispensaries mentioned they had no equipment for performing stool analysis and one dispensary had no laboratory personnel.

Table 6. Reported performance of Lab investigations

Type of investigation	Hospital (n=4)	HC (n=4)	Dispensaries (n=8)
1. Blood smear (BS) for malaria	4/4	4/4	5/8
2. Malaria Rapid Diagnostic Test	3/4	2/4	5/8
3. HB test	3/4	3/4	2/8
4. Stool analysis	3/4	4/4	4/8
5. Chest X-Ray	2/4	0/4	0/8
6. Random Blood Glucose (RBG)	3/4	3/4	4/8
7. Urinalysis	3/4	4/4	5/8
8. Widal Test	3/4	2/4	0/8
9. Lumbar Puncture	2/4	0/4	0/8
10. Cerebrospinal Fluids (CSF)	2/4	0/4	0/8
11. Urine culture	1/4	0/4	0/8
12. Blood culture	4/4	0/4	8/8
13. Full Blood Picture	2/4	3/4	2/8
14. CD4 Test	3/4	1/4	3/8
15. HIV Test	4/4	4/4	3/8
Note: Shaded cells are non-establishments for respective facility level			

5. Chest X-ray

All hospitals and health centres are expected to have chest X-ray machines. Dispensaries can have them subject to availability of enough resources. Two of the four hospitals were not performing chest x-rays and none of the health centres. These health facilities had had no X-ray machines.

6. Random Blood Glucose (RBG)

One hospital and one health centre were not performing RBG. Half (4/8) of the dispensaries were not capable of testing for blood glucose through RBG (or capillary blood glucose). The reasons for not performing RBG were said to be unavailability of equipment (one hospital, health centre and dispensary), lack of reagents. Dispensary level staff added inadequate laboratory staff as a reason for not doing the test.

7. Urinalysis

Urinalysis (or routine and microscopy) is considered to be one of the most common laboratory examination method. However the study found one hospital and three dispensaries that were not

performing this test. The hospital and one dispensary claimed to have no equipment. Another dispensary claimed they did not have laboratory personnel (because it has no laboratory).

8. Widal test

Although Widal test is only mandatory at hospital level, one hospital was not performing this procedure because it had had no equipment.

9. Lumbar puncture

Similarly, lumbar puncture procedure is mandatory at hospital and health centre levels. Two of the four hospitals were performing this procedure and none of the health centres. The main reason was lack of equipment.

10. Cerebrospinal Fluid (CSF)

Taking cerebral spinal fluid (a specimen normally taken through lumbar puncture) is supposed to be available at a hospital level. Only two hospitals were collecting this specimen. None of health centres were contacting it. The main reason for not performing this procedure was lack of equipment.

11. Urine culture

Only hospitals are required to perform this procedure. Three of the four hospitals were not performing urine culture. Two of these hospitals said that they have had no equipment to perform this procedure. Information for the other hospital was not available.

12. Blood culture

All hospitals were performing blood culture testing. Surprisingly, although this is not a requirement at dispensary level, all dispensaries were performing this procedure.

13. Full Blood Picture (FBP)

In principle, hospitals, health centres and dispensaries should be capable of performing full blood picture (FBP). Two hospitals and one health centre were not performing FBP. Two hospitals and two dispensaries had no equipment and one of these dispensaries had no laboratory.

14. CD4 Test

One of the rapid tests is counting CD4 that is supposed to be done at all levels of health facilities (except at the dispensary level). Surprisingly half of the health facilities (4/8) (one hospital and three health centers) were not performing this procedure. Only one hospital was not performing CD4 count test because the equipment was broken. Of the health centres had no equipment. Though not a requirement, 3 dispensaries were running CD4 count tests. One of the dispensaries said they did not have enough laboratory personnel to perform this procedure.

15. HIV test

The HIV rapid test is supposed to be performed at all levels. All hospitals and all health centres interviewed were performing this test. Five of the eight dispensaries were not performing this test. One dispensary said they had no equipment and were incompetent to perform the test. Two dispensaries lacked laboratory personnel and a lab.

5. DISCUSSION AND CONCLUSION

5.1 Discussion

The assessment was conducted in February 2015 with the main objective of assessing laboratory performance and associated challenges in the diagnosis of causes of fever in the Lake Zone of Tanzania.

The team documented available laboratory personnel and performance of laboratory investigations at each of the selected sites.

Like in many other developing countries in general and Tanzania in particular, the Lake Zone is experiencing health care workforce crisis specifically the laboratory personnel. District, health centers and dispensaries experience more shortages of health workers than higher levels facilities (Regional and specialized hospitals)⁹. But in this study, health centers experienced more shortage of laboratory staff. Although district hospitals are erratically staffed, health centers and dispensaries are understaffed with laboratory personnel¹⁰. Shortages of laboratory workforce and an increased patient load at health centers and dispensary levels restrict efforts to deliver quality laboratory investigations.

The number of laboratory investigations related to child fever varies by health facility level. The assessment team found a shortfall of laboratory investigations at each facility level. However this was more profound at health centers and dispensaries. Dispensaries not supported by THP reported more serious shortfall in the number of investigations (almost six times). However, lack of equipment and shortages of reagents (and other supplies) was cited in many instances. Consistent lack of equipment and unreliable supplies has been a common grievance in many Tanzania health facilities¹¹.

5.2 Conclusion

Health laboratories in the Lake Zone of Tanzania face a serious shortage of staff, equipment and supplies. Because of this, various laboratory investigations are not performed as required. Although THP is not currently focusing on placement of laboratory personnel and provision of equipment and essential supplies, results from this study suggest the need to address these two types of shortages in order to improve laboratory service efficiency. Without these changes the study believes the quality of diagnoses and treatment of under- fives fevers in the Lake Region will remain a problem.

6. RECOMMENDATIONS

The study recommends extending training to involve laboratory staff and create an understanding between clinicians and the lab technicians. The MoHSW should solicit for and make available basic equipment at dispensaries, a level that serves a greater part of the population.

7. LIMITATIONS OF STUDY

This study had some limitations. First, caution should be made when attempting to make inference because the study is a situational assessment meant only for health facilities in the Lake Zone. Second, reasons against unavailability of the test may not be exhaustive and some may be related (for example, no personnel and no equipment). Finally, although we thought interviews with the health facility's laboratory in-charge would give sufficient and possible limitations to perform lab investigations, sometimes these facility laboratory in-charges may not be much aware of the situations. This fact was realized during the analysis of data.

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